

What is claimed is:

1. An atmospheric-pressure, plasma generating apparatus for treating a surface of a workpiece, said apparatus comprising:
 at least one powerable electrode connectable to one or more power supplies and powerable thereby;
 at least one groundable electrode connectable to a ground,
 a dielectric intermediate said at least one powerable electrode and said at least one groundable electrode;
 a first plurality of said powerable electrodes and said groundable electrodes being disposed in pairs, each of said pairs generating a plasma zone and operatively associated with a second plurality of flow channels, whereby a plasma gas can flow through said flow channels and thereby produce a plasma therein upon interaction with said powerable electrode when powered, said plasma being capable of interacting with a working gas to thereby produce excited species, and
 a third plurality of outlets from said flow channels, said outlets being juxtaposable with a workpiece whereby the excited species may flow from interaction with said plasma through said outlets to impinge on the surface of the workpiece, said flow of said excited species being in a primary direction which is straight and unobstructed from said plasma to said surface of said workpiece
2. An apparatus according to claim 1 wherein said plurality of electrodes disposed in said flow channels comprises elongate electrodes disposed in elongate flow channels.
3. An apparatus according to claim 2 wherein said plurality of electrodes disposed in said flow channels are powerable, each said powerable electrode extending from a proximal end to a distal end, said distal end being juxtaposed with said outlet of said flow channel, said cross sectional area of said powerable electrode not increasing as said distal end is approached.
4. An apparatus according to claim 3 wherein said flow channels are disposed in an array comprising inner flow channels and outer flow channels, said outer flow channels having a greater cross-sectional area and/or density than said inner flow channels.
5. An apparatus according to claim 1, wherein at least one said powerable electrode is spaced about 10 micrometers to about 20 mm from at least one said groundable electrode.
6. An apparatus according to claim 1 comprising at least one electrode disposed in a flow channel and having a spiral configuration, said spirally configured electrode

substantially circumscribing or being substantially circumscribed by an opposite electrode to define a flow channel therebetween.

7. An apparatus according to claim 6 wherein said spirally configured electrode has a helical configuration.
8. An apparatus according to claim 6 comprising plural spirally configured electrodes disposed in a common flow channel.
9. An apparatus according to claim 1 wherein said at least one powerable electrode and said at least one groundable electrode are alternately disposed and comprise plates, said flow channels being intermediate and defined by said plates.
10. An apparatus according to claim 9 comprising plural and parallel alternately disposed powerable electrodes and groundable electrodes.
11. An apparatus according to claim 10, wherein at least one said powerable electrode is spaced about 10 micrometers to 20 mm from at least one said groundable electrode.
12. An apparatus according to claim 1 wherein said apparatus comprises a laminate of at least one powerable electrode, at least one groundable electrode disposed in face to face relationship and a dielectric interposed therebetween, said laminate having a plurality of flow channels therethrough.
13. An apparatus according to claim 12 comprising plural laminae of powerable electrodes, groundable electrodes and dielectrics interposed therebetween, said laminae being disposed in face to face relationship.
14. An apparatus according to claim 13 wherein said powerable electrode and said groundable electrode are not coextensive.
15. An apparatus according to claim 14 wherein said powerable electrode has a width, taken within the plane of the laminate of less than 2 mm.
16. An apparatus according to claim 13 comprising plural powerable electrodes, disposed on a common dielectric.
17. A method for treating a surface of a workpiece at atmospheric pressure using plasma, said method comprising the steps of:

providing an apparatus, said apparatus comprising at least one powerable electrode, said powerable electrode being connectable to a power supply and powerable thereby,

at least one groundable electrode connectable to a ground,

a dielectric separating said at least one powerable electrode and said at least one groundable electrode, whereby said at least one powerable electrode and at least one groundable electrode define a plurality of electrode pairs,

a first plurality of said powerable electrodes and/or said groundable electrodes being disposed in a second plurality of flow channels, whereby a plasma gas can flow

through said flow channels and thereby produce a plasma upon interaction with a powerable electrode when said powerable electrode is powered, said plasma being capable of interacting with a working gas to thereby produce excited species, and

a third plurality of outlets from said flow channels, said third plurality being juxtaposable with a workpiece whereby the excited species may intercept the surface of the workpiece;

supplying power to at least one said powerable electrode,

supplying a plasma gas to said plurality of flow channels;

generating a plasma from said plasma gas,

supplying a working gas in juxtaposed relationship with said plasma gas, whereby

said plasma interacts with said working gas to generate excited species, said excited species being suitable to treat a workpiece,

juxtaposing said plurality of outlets from said chamber with a workpiece, and

applying a treatment of said active species to a surface of the workpiece in a straight

and unobstructed flow path from said plasma to said surface of said workpiece.

18. A method according to claim 17 wherein said step of supplying power to said at least one powerable electrode comprises supplying different amounts of power to different powerable electrodes.
19. A method according to claim 17 wherein said step of supplying a working gas comprises supplying different working gasses through different flow channels.